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The Foraging Behaviour and Value of Pollination by Honeybees (*Apis mellifera* L.) in Linseed

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Abstract

Studies were carried out to see the foraging behaviour and role of pollination by honeybees (*Apis mellifera* L.) in Linseed, *Linum usitatissimum* L. Foragers visited the crop between 07.00-15.00 h with most intense visitation between 11.00-12.00 h (19.49/ flower/10 minutes) resulting, maximum yield, 1000 grain weight and germination percentage of 485.98 kg/acre, 7.085 gms and 96.51 percent, respectively. Thus seed pollinated by honeybees was found to be of good quality and quantity.

Introduction

Linseed, *Linum usitatissimum* L. contains 38 percent oil and is used-whole as a feed for horses and birds, or crushed to extract the oil, which is used for the manufacture of paints, painting inks, varnishes or in the treatment of timber. After crushing, the remaining linseed cake, which contains 33 percent. crude protein and 6-8 percent oil, is a premium protein feed, especially for ruminants (Williams, 1988) while flax fiber is the raw material of linen industry (Sundararaj and Thulasidas, 1993).

Linseed is generally considered to be a self-fertile and self pollinated crop but owing to the structure and mechanism of the flowers, cross pollination to varying percentage, have been observed (Sundararaj and Thulasidas, 1993). The amount of self and cross-pollination is influenced by the position of anthers relative to the stigma. In most of the cultivars, the anthers are above and entirely surround the stigma, favouring self-pollination, whereas, in some the tip of the stigma extends above the anthers, increasing the chance of cross-pollination (Yermanos and Kostopoulos, 1970). Similarly, the space between anthers and stigma at the time when flower is half open, also facilitate cross-pollination. The rate of cross-pollination increases in cultivars with large disc flowers than tubular ones (Rubis, 1970). Also both emasculated flowers (Rykova, 1973) and male sterile cultivars (Marchenkov and Kupyanskaya, 1977) have given good yields when open pollinated, indicating that when self-pollination is prevented, cross-pollination can be substantial.

Honeybees play a pivotal role in the cross-pollination of over 100 cultivated crops and the yield attributable to honeybees' pollination, was found to be about $9.3 billion in USA during 1985 (Bradbear and clement, 1991). Honeybees also rated as the most efficient pollinators of agricultural crops in Pakistan (Muzaffar, 1982) and the value of bees in crop pollination is 14 times the value of honey which they produce (Rehman and Singh, 1944).

Materials and Methods

Linseed variety 'Chandni' was sown at the Agricultural Research Farm, Sheikhupura on October, 1996-97, by adopting standard agronomic techniques.

Foraging Behaviour: Six inflourescences were selected randomly to determine the honeybee visitation frequency. For this purpose, studies were conducted from 07.00-15.00 h on each alternate day during flowering period from unsprayed sets of conditions. Peak hours of foraging activity/visitation frequency were noted by counting the number of bees recorded in a 10 minutes interval of each hour.

Effect of Honeybees' Pollination: Value of honeybees for pollination on seed production was assessed on 1000 -grain weight basis and by testing germination percentage of linseed. Yield of linseed was also recorded from open and caged plots. The following methodology was followed to record above parameter.

Pollination by Honeybees: The linseed crop was covered with polythene sheet (4' x 5' x 6') at three different places and were made pollinator free before two week of flowering by spraying Primer 50W at 617.50 ml/ha. Then at flowering, in each plot, one bee hive was introduced with double entrance hole in such a way that one hole in the cage and the other opened out in the field to save the colony from shortage of food. The data on honeybee visitation frequency were recorded.

Pollination by Wind: To study wind as a pollinating agent three plots were made in the linseed crop by covering them with mosquito net bag (4' x 5' x 6'). These plots were also made pollinator free by spraying Primer 50W at 617.50 ml/ha after flowering.

Pollination by Honeybees, Wind and Pollinators: For this purpose, an area of 4' x 5' was marked at three different places in the linseed crop field. The other insect visitors were also recorded.

Results and Discussion

On clear days honeybees constituted 80 percent of insect species, visited the linseed flowers from unsprayed sets of conditions during the time when the nectar and pollen was

available. Many species of insects have been recorded so far by Gubin (1945) and Hassanein (1955). But insect pollinators, other than honeybees, during current studies were found to be flies (Syrphidae, Muscidae), butterflies (Pieridae), Ladybird beetles (Coccinellidae), thrips (Thripidae) and wasps (Vespidae).

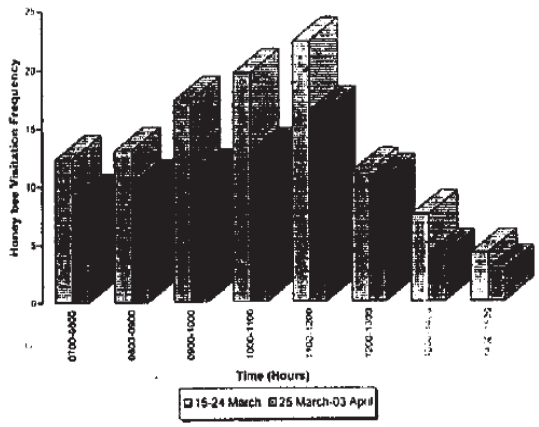

Fig. 1: Honeybees Visitation Frequency per 10 Minutes per Flower

Fig. 1 shows the honeybees' visitation started from 07.00-15.00 h, but the most intense visitation was recorded between 11.00-12.00 h. Honeybees' visits ranged from 04.25 to 22.42/10 minutes/flower during 15-24 March while it remained 02.85 to 16.57 visits/ 10 minutes/flower during 25 March - 03 April. This difference of honeybee visitation frequency during 15-24 March and 25 March-03 April was due to the gradual depletion of nectar and pollen at the end of flowering season. A further analysis of Fig. 1 also showed the maximum visits of 19.49 with least of 03.50 at 11.00-12.00 h and 14.00-15.00 h, respectively. These results are partially in accordance with those of Smirnov (1954) who observed the most intense visitation between 08.00 and 11.00 h. This little variation is probably due to the difference in weather conditions. The decrease in pollination activity after 12.00 h was due to the fact that the most petals shed by noon or soon thereafter and honeybees were not in a position to get a support of petals during foraging (Gubin, 1945).

Table 1: Efficiency of different pollinating agents in obtaining the potential linseed yield

Pollinating Agent	1000 Grain weight (g)	Germination percentage	Yield (kg/acre)
Honeybees	7.085	96.51	485.98
Wind	3.870	70.19	265.65
Honeybees + Wind Pollinators	5.975	90.16	373.43

The results of present studies (Table 1) reveal that the maximum linseed yield (485.98 kg/ acre), 1000 grain weight (7.085 gms) and germination percentage (96.51) was obtained in case of plots pollinated by honeybee resulting a 30.14 percent increase in yield as compared the plots pollinated by "honeybee + wind + other pollinators with 373.43 kg/acre, 5.975 gms and 90.16 percent respectively. The results reported by Williams (1988) support the present findings who stated 18-49 percent increase in seed yield, when honey bees were used the pollinate the crop. However, the least yield (265.6 kg/acre), 1000 grain weight (3.87 gms) and germination percentage (70.19°A)) was recorded in case of plot pollinated by wind only. These findings are at par wit those of Gubin (1945) who reported wind as not s important pollinating agent of linseed crop.

These results lead to the conclusion that the pollination due to the activity of honeybees helps to increase the yield to 30.14 percent and improve the quality as well.

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